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NOTIFICATION OF ELECTION

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To:

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in its capacity as elected Office

Date of mailing (day/month/year) 12 July 2001 (12.07.01)	
International application No. PCT/SE00/01863	**Applicant's or agent's file reference** PC-2009026
International filing date (day/month/year) 26 September 2000 (26.09.00)	**Priority date** (day/month/year) 07 October 1999 (07.10.99)
Applicant SELDER, Mikkel	

1. The designated Office is hereby notified of its election made:

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04 May 2001 (04.05.01)

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

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Published:
— *With international search report.*
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/24982 A1

(54) Title: METHOD OF IMPREGNATION

(57) Abstract: A process for the impregnation of cellulose-based products, particularly wood, comprising treatment f the product with linseed oil at an increased temperature under pressure in an autoclave, comprising the steps: a) charging the autoclave with the product to be treated, b) charging the autoclave with linseed oil heated to a temperature exceeding the boiling point of water so that the product wil be surrounded by linseed oil, c) applying vacuum to the autoclave while keeping the temperature constant, water in the form of steam and air enclosed in the product being released from the product, d) discharging the linseed oil from the autoclave with simultaneous supply of linseed oil of a temperature lower than the boiling point of water and preferably applying over-pressure to the autoclave, and e) discharging the cold oil from the autoclave which, optionally, for the removal of excess oil from the product is again set under vacuum, whereafter the impregnated product is removed from the autoclave.

METHOD OF IMPREGNATION

The present invention relates to a process for linseed oil impregnation of a product based on cellulose, particularly wood, such as lumber, other wood products and the like. The process involves treatment of the product with linseed oil at an increased temperature under pressure in an autoclave.

Even if the present invention is applicable in relation to other cellulose-based products than wood the invention will in the following be described in connection with wood in the form of different types of lumber. Decomposition of wood when used outdoors is almost exclusively caused by fungi and bacteria. The requirement for growth of such micro-organisms is the presence of water. Furthermore, a suitable temperature and access to nutrition and oxygen are required. Prevention of decomposition can be based on the elimination of one or more of these conditions necessary for the growth of the micro-organisms. As an example there can be mentioned that if the moisture content is brought down to a value lower than about 20% biological decomposition is substantially prevented.

A number of different impregnation processes for the protection of wood are known, and these methods can in principle be divided up into techniques based on the supply of a substance poisonous to the growth of the micro-organisms, and techniques whereby the wood is given hydrophobic properties, for example by impregnation with some kind of oil. In the latter case an impregnation agent is crude linseed oil which can be of hot- or cold-pressed type, both of which by suitable heat treatment are converted into boiled linseed oils.

Most of the known methods for oil impregnation of lumber is based on the principle of using overpressure during the impregnation procedure. Moreover, impregnation

methods are known which are based on the so called principle "hot and cold-process", i.e. the lumber is initially treated in hot oil and is then transferred into cold oil whereby a certain improved impregnation result is obtained. The known methods are, however, unsatisfactory with regard to obtaining a degree of impregnation resulting in extended protection against attack by micro-organisms present in nature, for example micro-organism flora of aggressive brown rot.

The present invention has for an object to provide a process for linseed oil impregnation of cellulose-based products, particularly wood, the new process resulting in a substantially improved protective effect, especially in view of the fact that the process enables a higher level of uptake.

Another object of the invention is to provide a multi-step process utilizing an initial heating step in which water in the form of vapour and enclosed air is released from the product, and a subsequent step where the result of the water and air release is used to improve the uptake of oil.

Yet an object of the invention is to provide a process with alternate use of vacuum in combination with high temperature and then cooling in combination with over-pressure.

A particular object of the invention is to make certain in the process that the transition from the vacuum-heating step to the pressure-cooling step takes place continuously so that maximum benefit of this transition will be obtained.

For these and other objects which will be clear from the following description the invention provides for a process for the impregnation of cellulose-based products, particularly wood, with linseed oil, the products being treated with linseed oil at an increased temperature and under pressure in an autoclave. The invention is characterized by the following steps:

a) the autoclave is charged with the product to be treated,

b) linseed oil heated to a temperature exceeding the boiling point of water is introduced into the autoclave so that the product is surrounded by linseed oil,

c) while keeping the temperature at a constant level the autoclave is put under vacuum, water in the form of steam and air enclosed in the product being released from the product,

d) the linseed oil is discharged from the autoclave with simultaneous supply of linseed oil having a temperature lower than the boiling point of water and the autoclave is preferably put under overpressure, and

e) the cold oil is discharged from the autoclave which, optionally, for removal of excess oil from the product is again put under vacuum, the impregnated product then being removed from the autoclave.

The process according to the present invention is in principle based on the new concept that the switching over of the autoclave from hot linseed oil under vacuum takes place continuously by introducing cold linseed oil simultaneously with decharging the hot linseed oil from the autoclave, the autoclave being progressively put under overpressure. By this procedure the vacuum in the product generated under heat and autoclaved vacuum is utilized at a maximum so that optimal uptake of linseed oil takes place in connection with the supply of cold linseed oil and putting the autoclave under overpressure.

In the present disclosure the expressions "hot linseed oil" and "cold linseed oil" thus mean that the temperature of the oil in the first case exceeds the boiling point of water and in the latter case is lower than the boiling point of water, respectively.

In step a) it is suitable to heat the linseed oil to a temperature of about 140-180°C, whereas in the latter step c) it is preferred to put the autoclave under over-

pressure of up to about 15 bar, for example from about 5 to about 12 bar.

In the cooling step d) the temperature of the cold linseed oil is suitably maintained within the range about +75 to about +85°C.

In the process according to the present invention it is particularly preferred to use for the impregnation a processed linseed oil substantially consisting of linolenic acid, linolic acid and oleic acid, mainly in the form of triglycerides, the content of free tocoferol of the linseed oil being less than about 100 ppm. The linseed oil content of free tocoferol is suitably less than about 75 ppm and particularly less than about 50 ppm. Details regarding such processed linseed oil and the process for the manufacture thereof is found in patent application No. SE 9903621-2 filed simultaneously herewith with the same applicant and the same inventor. The contents of this co-pending patent application is incorporated herein by reference.

Finally, the process may in a further final step be dried in an air flow of environmental temperature.

The present invention also covers products, particularly wood products, obtained by the process described above.

The invention will in the following be further described in connection with no-limiting examples, wherein the percentages given relate to weight if not otherwise stated.

EXAMPLE 1

Impregnation procedure

In connection with the impregnation procedure there is used Swedish cold-pressed linseed oil from the harvest of 1998.

An autoclave is charged with lumber to be treated, in the present case rods which have been distributed and anchored. The autoclave is charged with linseed oil

heated to a temperature within the range about 140 to about 180°C, for example about 160°C, and the autoclave is charged so that the lumber is completely surrounded by linseed oil. The temperature is maintained at a constant level while the autoclave is put under vacuum. In view of the high temperature to which the lumber is heated and under the influence of vacuum the water will evaporize and water steam together with air will leave the pore system of the lumber.

After finished heat treatment which takes place for a period of about 1 h, the hot oil is continuously replaced with cold oil by pumping the hot oil out of the autoclave at the same time pumping cold oil into the autoclave at the bottom thereof. At the same time as this replacement of hot oil with cold oil the pressure in the autoclave is progressively increased from vacuum to an overpressure of about 10 bar. The temperature of the cold oil is maintained within the range about +75 to about +85°C. In cooling of the lumber a sub-pressure is created in the pore system thereof, whereby impregnating oil more easily impregnates the lumber so as to increase the level of uptake.

After finished treatment in the autoclave the lumber is allowed to dry in a cool flow of air at a temperature of about 20°C or lower, whereby excess of oil further penetrates into the lumber. This final step has for a function to prevent that oil by later sweating emerges from the impregnated lumber.

EXAMPLE 2

Result of impregnation

The lumber made subject to impregnation can be of any type. In Sweden the trend is presently towards the common coniferous trees, namely fir and pine. The lumber can be fresh or dried in different degrees, i.e. contain different amounts of moisture.

The time periods of the different process steps will have to be adapted to the parameters of the lumber (dimension, moisture content, type of wood, core and/or sapwood) and to the uptake level desired. The uptake level can be given in quantity of linseed oil per cubic meter or percent of the dry density of the lumber which is about 450 kg/m^3, and further with regard to the intended use of the impregnated lumber. The higher the uptake level obtained the better resistance of the lumber and the harder conditions endured by lumber in its practical use.

Different types of lumber have been test impregnated in accordance with the process of the invention, and in the following table these types of lumber and the uptake levels obtained are given.

TABLE

Type of lumber (density 450 kg/m^3)	Approximate uptake level %	About kg/m^3
Pine sap	100%	450 kg/m^3
Pine core	40%	180 kg/m^3
Fir sap	40%	180 kg/m^3
Fir core	20%	90 kg/m^3

Lumber impregnated to high levels of uptake, i.e. up to 100%, can according to ongoing tests endure long periods of time under quite severe conditions, i.e. freely outdoors in ground or in ground contact.

It should be observed that the present invention is not restricted to the specific embodiments exemplified above. Thus, modifications and changes can be carried out within the frame-work of the invention and such changes and modifications are easily understood by those skilled in the art.

CLAIMS

1. A process for the impregnation of cellulose-based products, particularly wood, comprising treatment of the product with linseed oil at an increased temperature under pressure in an autoclave, characterized by the steps:

a) charging the autoclave with the product to be treated,

b) charging the autoclave with linseed oil heated to a temperature exceeding the boiling point of water so that the product will be surrounded by linseed oil,

c) applying vacuum to the autoclave while keeping the temperature constant, water in the form of steam and air enclosed in the product being released from the product,

d) discharging the linseed oil from the autoclave with simultaneous supply of linseed oil of a temperature lower than the boiling point of water and preferably applying over-pressure to the autoclave, and

e) discharging the cold oil from the autoclave which, optionally, for the removal of excess oil from the product is again set under vacuum, whereafter the impregnated product is removed from the autoclave.

2. A process according to claim 1, characterized in that in step a) the linseed oil is heated to a temperature of about 140 to 180°C.

3. A process according to claim 1 or 2, characterized in that in step c) the autoclave is set under an over-pressure of up to about 15 bar.

4. A process according to any one of the preceding claims, characterized in that in step d) the temperature of the cold linseed oil is maintained within the range about 75 to 85°C.

5. A process according to any one of the preceding claims, characterized in that in step d) the over-pressure is from about 5 bar to about 12 bar.

6. A process according to any one of the preceding claims, characterized in that the impregnation is carried out with a processed linseed oil substantially consisting

of linolenic acid, linolic acid and oleic acid, mainly in the form of triglycerides, the contents of the oil of free tocoferol being less than about 100 ppm.

7. A process according to claim 6, characterized in that the contents of free tocoferol of the linseed oil is less than about 75 ppm.

8. A process according to claim 7, characterized in that the contents of free tocoferol of the linseed oil is less than about 50 ppm.

9. A process according to any one of the preceding claims, characterized in that the product in a further final step is dried in an air flow of environmental temperature.

10. Products produced by the process according to any one of the preceding claims.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01863

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B27K 3/02, B27K 3/08, B27K 3/34
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B27K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3968276 A (WILLIAM R. ALLEN), 6 July 1976 (06.07.76) --	1-10
A	US 5652023 A (ANTHONY J. BERGERVOET ET AL), 29 July 1997 (29.07.97) --	1-10
A	WO 9846403 A1 (BWG BUTZBACHER WEICHENBAU GMBH), 22 October 1998 (22.10.98) --	1-10
A	WO 9411167 A1 (HUNGBAU KFT.), 26 May 1994 (26.05.94) --	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 2001	05 -02- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Solveig Gustavsson/EÖ Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01863

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9219429 A1 (SCHIRNIG, ULRICH, HERBERT), 12 November 1992 (12.11.92) -- --------	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 00/01863

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3968276 A	06/07/76	NONE	
US 5652023 A	29/07/97	AU 1979497 A	16/09/97
		EP 0907424 A	14/04/99
		US 5824370 A	20/10/98
		WO 9731724 A	04/09/97
WO 9846403 A1	22/10/98	AU 7524198 A	11/11/98
		DE 19715664 A	22/10/98
		DE 19880454 D	00/00/00
		LU 90459 A	25/10/99
		PL 336272 A	19/06/00
WO 9411167 A1	26/05/94	AU 5573994 A	08/06/94
		HU 9203611 D	00/00/00
WO 9219429 A1	12/11/92	AT 117238 T	15/02/95
		AU 1789092 A	21/12/92
		DE 69201239 D,T	18/05/95
		DK 84891 A	08/11/92
		DK 172239 B	02/02/98
		EP 0576608 A,B	05/01/94

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REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty

For receiving Office use only

International Application No. PCT/ SE 00 / 0 1 8 6 3

International Filing Date 26 -09- 2000

The Swedish Patent Office
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired)(12 characters maximum)* PC-2009026

Box No. I TITLE OF INVENTION

METHOD OF IMPREGNATION

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

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Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: SWEDEN

State *(that is, country)* of residence: SWEDEN

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR /FURTHER INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

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SWEDEN

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☐ applicant only
☒ applicant and inventor
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☐ Further applicants and/or (further) inventors are indicated on a continuation sheet

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below ~~is hereby~~/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

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Box No. V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **MZ** Mozambique, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

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National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

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☒ **KR**	Republic of Korea	+Utility Model	
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☐ _____ ☐ _____

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

PCT/SE 00 / 0 1 8 6 2

26 -09- 2000

Sheet No. 3

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplement Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 7 October 1999	9903622-0	SWEDEN		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): ———

** Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(If two or more International Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA / SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	: 3
description (excluding sequence listing part)	: 6
claims	: 2
abstract	: 1
drawings	:
sequence listing part of description	:
Total number of sheets	: 12

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference No., if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international applications into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listning in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: Swedish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

26 September 2000

Tore Burman

authorised Agent

For receiving Office use only

1. Date of actual receipt of the Purported international application: 26 -09- 2000		2. Drawings: ☐ received: ☒ not received:
3. Corrected date of actual receipt due to later but Timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required Corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA/ SE	6. ☐ Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 10 NOVEMBER 2000 — 10 NOV 2000

PCT/SE 00/ 0 1 8 6 2
26 -09- 2000

AWAPATENT AB
Kontor/Handläggare
Stockholm/Tore Burman/LFG

AB KULTURHANTVERKARNA
Ansökningsnr
Vår referens
SE-2998784

IMPREGNERINGSFÖRFARANDE

Föreliggande uppfinning avser ett förfarande för linoljeimpregnering av en cellulosabaserad produkt, speciellt trä, såsom trävirke, andra trävaror och dylikt. Förfarandet innebär behandling av produkten med linolja vid förhöjd temperatur under tryck i autoklav.

Även om föreliggande uppfinning är tillämpbar i anslutning till andra cellulosabaserade produkter än trä kommer uppfinningen fortsättningsvis att beskrivas i anslutning till trä i form av olika typer av trävirke. Nedbrytning av trä vid användning utomhus förorsakas så gott som uteslutande av svampar och bakterier. Förutsättningen för dessa mikroorganismers tillväxt är närvaro av vatten. Dessutom erfordras lämplig temperatur och tillgång till näring och syre. Förhindrandet av nedbrytningen kan basera sig på att man eliminerar en eller flera av dessa för mikroorganismernas tillväxt erforderliga förhållanden. Som exempel kan nämnas att om fukthalten bringas till ett värde understigande ca 20% biologisk nedbrytning väsentligt förhindras.

Ett antal olika impregneringsmetoder för att skydda trä är kända, och dessa metoder kan i princip uppdelas i teknik baserad på tillförsel av ett för mikroorganismernas tillväxt giftigt ämne, och teknik varigenom träet bibringas hydrofoba egenskaper, exempelvis genom impregnering med någon olja. Vid den senare tekniken är ett impregneringsmedel rå linolja som kan vara av varm- eller kallpressad typ vilka båda genom lämplig värmebehandling överföres till kokta linoljor.

De flesta kända metoder för oljeimpregnering av virke bygger på principen med användning av övertryck under impregneringsproceduren. Likaså är impregneringsmetoder kända vilka bygger på den s.k. principen med "hot and cold-process", dvs virket behandlas först i het olja och

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överföres sedan i kall olja varigenom en viss förbättrad impregneringseffekt erhålles. De kända metoderna är emellertid otillfredsställande när det gäller att erhålla en impregneringsgrad som ger långvarigt skydd mot angrepp av mikroorganismer som förekommer i naturen, exempelvis mikroorganismflora med aggressiv brunröta.

Föreliggande uppfinning har till ändamål att åstadkomma ett förfarande för linoljeimpregnering av cellulosabaserade produkter, speciellt trä, varvid det nya förfarandet ger väsentligt förbättrad skyddsverkan, speciellt genom att förfarandet möjliggör en högre upptagningsnivå.

Ett annat ändamål med uppfinningen är att åstadkomma ett flerstegsförfarande, som utnyttjar ett inledande upphettningssteg varvid vatten i ångform och innesluten luft avgår från produkten, och ett efterföljande steg där man tar till vara resultatet av vatten- och luftavgången så att oljeupptagningen kan förbättras.

Ännu ett ändamål med uppfinningen är att åstadkomma ett förfarande, vid vilket man omväxlande utnyttjar vakuum i kombination med hög temperatur och därefter kylning i kombination med övertryck.

Ett speciellt ändamål med uppfinningen är att man vid förfarandet tillser att övergången från vakuum-värmningssteget till tryck-kylsteget sker kontinuerligt så att maximal utnyttjning av denna övergång uppnås.

För dessa och andra ändamål som kommer att framgå av den fortsatta beskrivningen åstadkommes genom uppfinningen ett förfarande för impregnering av cellulosabaserade produkter, speciellt trä, med linolja, varvid produkterna behandlas med linolja vid förhöjd temperatur under tryck i autoklav. Uppfinningen karakteriseras av följande delsteg:

a) autoklaven chargeras med aktuell produkt,

b) linolja upphettad till en temperatur överstigande vattnets kokpunkt tillföres autoklaven så att produkten omslutes av linoljan,

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c) under konstanthållning av temperaturen sätts autoklaven under vakuum, varvid vatten i ångform och i produkten innesluten luft avgår från produkten,

d) linoljan avtappas från autoklaven under samtidig tillförsel av linolja med en temperatur understigande vattnets kokpunkt och autoklaven företrädesvis sätts under övertryck, och

e) den kalla oljan avtappas från autoklaven, som eventuellt för avlägsnande av överskottsolja från produkten åter sätts under vakuum, varefter den impregnerade produkten avlägsnas från autoklaven.

Förfarandet enligt föreliggande uppfinning bygger i princip på det nya konceptet att autoklavens omställning från het linolja under vakuum sker kontinuerligt genom att samtidigt som den heta linoljan avtappas från autoklaven kall linolja tillföres och autoklaven successivt sätts under övertryck. Genom detta förfaringssätt utnyttjas maximalt det vakuum i produkten som uppstår under värme och vakuum så att maximal upptagning av linolja sker i anslutning till tillförsel av kall linolja och försättning av autoklaven under övertryck.

I föreliggande framställning innebär sålunda uttrycken "het linolja" och "kall linolja" att oljans temperatur i det första fallet överstiger vattnets kokpunkt, respektive i det senare fallet understiger vattnets kokpunkt.

I delsteg a) är det lämpligt att upphetta linoljan till en temperatur av ca 140-180°C, medan i det senare delsteget c) det är föredraget att autoklaven försättes under ett övertryck av upp till ca 15 bar, exempelvis från ca 5 till ca 12 bar.

I kylningssteget d) hålles den kalla linoljans temperatur lämpligen inom intervallet ca +75 till ca +85°C.

Vid förfarandet enligt föreliggande uppfinning är det speciellt föredraget att för impregneringen använda en processad linolja som till övervägande delen består av linolensyra, linolsyra och oleinsyra, främst i form av

triglycerider, varvid dess innehåll av fri tokoferol understiger ca 100 ppm. Linoljans innehåll av fri tokoferol understiger lämpligen ca 75 ppm och i synnerhet ca 50 ppm. Detaljer beträffande sådan processad linolja och förfarandet för deras framställning återfinnes i patentansökan nr ---- inlämnad samtidigt härmed med samma sökande och samma uppfinnare. Innehållet i denna parallellansökan får anses ingå i föreliggande patentansökan genom hänvisningen till densamma.

Slutligen kan förfarandet i ett ytterligare slutligt delsteg torkas i en luftström av omgivningstemperatur.

Föreliggande uppfinning innefattar även produkter, speciellt trävaror, framställda genom ovan beskrivet förfarande.

Uppfinningen kommer i det följande att närmare beskrivas i anslutning till icke inskränkande exempel, vari mängden procentangivelser avser vikten om ej annat anges.

EXEMPEL 1

Impregneringsprocedur

I anslutning till impregneringsproceduren användes svensk kallpressad linolja från 1998 års skörd.

I en autoklav tillföres aktuellt virke, i föreliggande fall stavar vilka ströats och förankrats. Autoklaven tillföres linolja uppvärmd till en temperatur inom intervallet ca 140 till ca 180°C, exempelvis ca 160°C och autoklaven fylles upp så att virket helt omsluts av linoljan. Temperaturen hålls vid konstant värde medan autoklaven försättes under vakuum. Genom den höga temperatur som trävirket upphettas till och under inverkan av vakuuet förångas vattnet och vattenånga tillsammans med luft avgår ur virkets porsystem.

Efter avslutad värmebehandling som äger rum under en tidrymd av ca 1 h utbytes den heta oljan kontinuerligt mot kall olja genom att den heta oljan pumpas ut ur autoklaven medan kall olja samtidigt pumpas in nedtill i autoklaven. Samtidigt med detta utbyte av het olja mot kall

olja växlas successivt trycket i autoklaven från vakuum till ett övertryck om ca 10 bar. Den kalla oljans temperatur hålles inom intervallet ca +75 till ca 85°C. Vid nedkylningen av virket skapas ett undertryck i dess porsystem, varigenom impregneringsolja lättare tränger in i virket så att upptagningsnivån ökar.

Efter avslutad behandling i autoklaven får virket torka i en sval luftström med en temperatur av ca -20°C eller lägre, varvid eventuellt oljeöverskott ytterligare inträngер i virket. Detta slutsteg har till funktion att förhindra att olja genom eftersvettning tränger ut ur det impregnerade virket.

EXEMPEL 2

Impregneringsresultat

Det virke som görs till föremål för impregnering kan vara av varjehanda slag. Inriktningen i Sverige är för närvarande mot de vanligaste barrträden, nämligen gran och fur. Virket kan vara i olika grad färskt eller torkat, dvs innehålla olika mängder fukt.

De olika processtegens varaktighet i tiden får anpassas till virkets parametrar (dimension, fuktkvot, träslag, kärna och/eller splint) samt till den eftersträvade upptagningsnivån. Upptagningsnivån kan anges i mängd linolja per m^3 eller procent av virkets torrdensitet som är ca 450 kg/m^3 , och vidare med hänsyn till det impregnerade virkets tilltänkta användning. Ju högre upptagningsnivå som erhålles desto bättre beständighet får virket och desto svårare förhållanden klarar virket av vid dess praktiska användning.

Olika typer av virke har genom förfarandet enligt uppfinningen provimpregnerats, och i följande tabell anges dessa virkesslag och de erhållna upptagningsnivåerna.

TABELL

Virkesslag (densitet 450 kg/m^3	Upptagningsnivå ca%	ca kg/m^3
Furusplint	100%	450 kg/m^3
Furukärna	40%	180 kg/m^3
Gransplint	40%	180 kg/m^3
Grankärna	20%	90 kg/m^3

Virke som impregnerats till höga upptagningsnivåer, dvs upp till 100%, kan enligt pågående tester klara lång tid under mycket svåra förhållanden, dvs fritt utomhus i mark eller i markkontakt.

Det bör observeras att föreliggande uppfinning ej är inskränkt till de konkreta utföringsformer som exemplifierats ovan. Sålunda kan modifikationer och ändringar utföras inom uppfinningens ram och sådana ändringar och modifikationer inses lätt av fackmannen på området.

PATENTKRAV

1. Förfarande för linoljeimpregnering av en cellulosabaserad produkt, speciellt trä, innefattande behandling av produkten med linolja vid förhöjd temperatur under tryck i autoklav, k ä n n e t e c k n a t av delstegen:

a) autoklaven chargeras med aktuell produkt,

b) linolja upphettad till en temperatur överstigande vattnets kokpunkt tillföres autoklaven så att produkten omslutes av linoljan,

c) under konstanthållning av temperaturen sätts autoklaven under vakuum, varvid vatten i ångform och i produkten innesluten luft avgår från produkten,

d) linoljan avtappas från autoklaven under samtidig tillförsel av linolja med en temperatur understigande vattnets kokpunkt och autoklaven företrädesvis sätts under övertryck, och

e) den kalla oljan avtappas från autoklaven, som eventuellt för avlägsnande av överskottsolja från produkten åter sätts under vakuum, varefter den impregnerade produkten avlägsnas från autoklaven.

2. Förfarande enligt patentkravet 1, k ä n n e t e c k n a t därav, att i delsteg a) linoljan upphettas till en temperatur av ca 140 till 180°C.

3. Förfarande enligt patentkravet 1 eller 2, k ä n n e t e c k n a t därav, att i delsteg c) autoklaven sätts under ett övertryck av upp till ca 15 bar.

4. Förfarande enligt något av de föregående patentkraven, k ä n n e t e c k n a t därav, att i delsteg d) den kalla linoljans temperatur hålles vid en temperatur liggande inom intervallet ca 75 till 85°.

5. Förfarande enligt något av de föregående patentkraven, k ä n n e t e c k n a t därav, att i delsteg d) övertrycket är från ca 5 bar till ca 12 bar.

6. Förfarande enligt något av de föregående patentkraven, k ä n n e t e c k n a t därav, att impregneringen utföres med en processad linolja till övervägande delen bestående av linolensyra, linolsyra och oleinsyra,

främst i form av triglycerider, varvid dess innehåll av fri tokoferol understiger ca 100 ppm.

7. Förfarande enligt patentkravet 6, k ä n n e t e c k n a t därav, att linoljans innehåll av fri tokoferol understiger ca 75 ppm.

8. Förfarande enligt patentkravet 7, k ä n n e t e c k n a t därav, att linoljans innehåll av fri tokoferol understiger ca 50 ppm.

9. Förfarande enligt något av de föregående patentkraven, k ä n n e t e c k n a t därav, att produkten i ett ytterligare slutligt delsteg torkas i en luftström av omgivningstemperatur.

10. Produkter framställda genom förfarande enligt något av de föregående patentkraven.

SAMMANDRAG

Förfarande för linoljeimpregnering av en cellulosabaserad produkt, speciellt trä, innefattande behandling av produkten med linolja vid förhöjd temperatur under tryck i autoklav, och innefattande följande delsteg:

a) autoklaven chargeras med aktuell produkt,

b) linolja upphettad till en temperatur överstigande vattnets kokpunkt tillföres autoklaven så att produkten omslutes av linoljan,

c) under konstanthållning av temperaturen sätts autoklaven under vakuum, varvid vatten i ångform och i produkten innesluten luft avgår från produkten,

d) linoljan avtappas från autoklaven under samtidig tillförsel av linolja med en temperatur understigande vattnets kokpunkt och autoklaven företrädesvis sätts under övertryck, och

e) den kalla oljan avtappas från autoklaven, som eventuellt för avlägsnande av överskottsolja från produkten åter sätts under vakuum, varefter den impregnerade produkten avlägsnas från autoklaven.

PATENT COOPERATION TREATY

PCT

REC'D 29 JAN 2002
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
PC-2009026		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE00/01863	26.09.2000	07.10.1999
International Patent Classification (IPC) or national classification and IPC7		
B27K 3/02, B27K 3/08, B27K 3/34		
Applicant		
Järlåsa Färgindustrier AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04.05.2001	21.01.2002
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Solveig Gustavsson/BS Telephone No. 08-782 25 00

Telex 17978 PATOREG-S

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRE[redacted]NARY EXAMINATION REPORT

International application No.
[redacted]/SE00/01863

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRE[redacted]NARY EXAMINATION REPORT

International application No.
[redacted]/SE00/01863

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-10	YES
	Claims		NO
Inventive step (IS)	Claims	1-10	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-10	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

1. US 3968276 A
2. US 5652023 A
3. WO 9846403 A1
4. WO 9411167 A1
5. WO9219429 A1

The cited documents represent the general state of the art.

The invention defined in claims 1-10 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed process for impregnation of cellulose-based products, such as wood. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-10 is novel and is considered to involve an inventive step. The invention is industrially applicable.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PC-2009026	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE00/01863	International filing date *(day/month/year)* 26.09.2000	Priority date *(day/month/year)* 07.10.1999
International Patent Classification (IPC) or national classification and IPC7 B27K 3/02, B27K 3/08, B27K 3/34		
Applicant Järlåsa Färgindustrier AB et al		

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- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04.05.2001	21.01.2002
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Solveig Gustavsson/BS Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRE [illegible] NARY EXAMINATION REPORT

International application No.
[illegible]/SE00/01863

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

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3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

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☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRE[redacted]NARY EXAMINATION REPORT

International application No.
[redacted]/SE00/01863

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-10	YES
	Claims		NO
Inventive step (IS)	Claims	1-10	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-10	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

1. US 3968276 A
2. US 5652023 A
3. WO 9846403 A1
4. WO 9411167 A1
5. WO9219429 A1

The cited documents represent the general state of the art.

The invention defined in claims 1-10 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed process for impregnation of cellulose-based products, such as wood. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-10 is novel and is considered to involve an inventive step. The invention is industrially applicable.